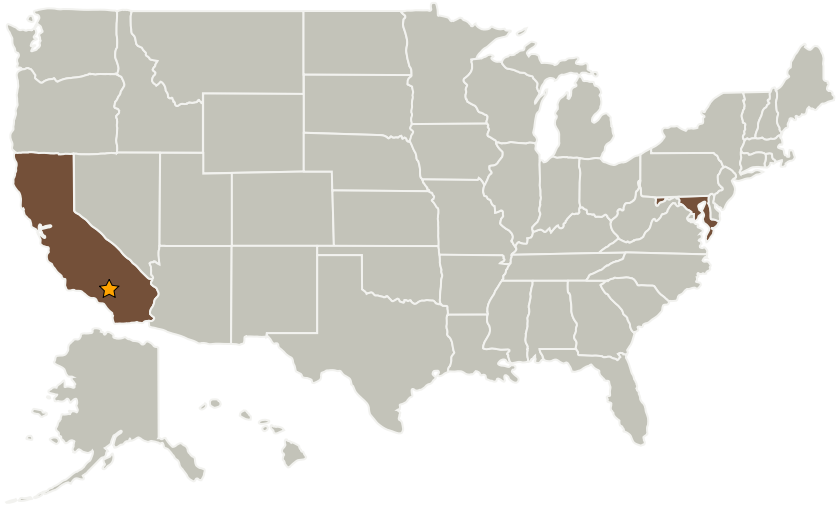
A Thin Film Transistor Based Ultrasonic Sensor for Aircraft Integrity Monitoring, Phase I

Completed Technology Project (2005 - 2006)

Project Introduction

Intelligent Automation, Incorporated (IAI) and its subcontractor, Penn State U., propose a novel system to detect damage in aircraft structures. The system combines novel TFT based thin film actuators and sensors for signal acquisition and a robust software for fault prognosis and diagnosis. The actuator/sensor is known as PVDF-IDT (Polyvinylidine Fluoride Interdigital Transducer) that is integrated into a TFT switching circuit. It is low cost, compact, flexible, and has great potential for wireless interrogation. PVDF-IDT sensor has been proven to be useful for sensing cracks in rivet holes as well as other structural defects such as corrosion, delamination, and fatigue cracking. The second element of the system is an automatic fault prognosis tool, which consists of Principal Component Analysis (PCA), Learning Vector Quantization (LVQ), and Hidden Markov Model (HMM). PCA is a popular neural network tool for extracting useful features. LVQ is used to generate the code sequence. HMM has been proven to be extremely useful in several applications, however, HMM is used here to perform both fault prognosis and diagnosis. Our proposed system can perform continuous monitoring of aircraft structures in both ground and in-flight situations, and the sensors can be easily embedded into the structure.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Armstrong Flight Research Center (AFRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Armstrong Flight Research Center(AFRC)	Lead Organization	NASA Center	Edwards, California
Intelligent Automation, Inc.	Supporting Organization	Industry	Rockville, Maryland

Primary U.S. Work Locations	
California	Maryland

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX13 Ground, Test, and Surface Systems
  - TX13.2 Test and Qualification
    - TX13.2.6 Advanced Life-Cycle Testing Techniques